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HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

03/17/00

JC525 U.S. PTO 09/531161 03/17/00

UTILITY PATENT APPLICATION TRANSMITTAL *(Only for new nonprovisional applications under 37 C.F.R. 1.53(b))*	Attorney Docket No.	2704.1001-003
	First Named Inventor or Application Identifier	David M. Greschler
	Express Mail Label No.	EL290727188US

Title of Invention	Port Proxy Method and System for Server and Client Computers

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: **Assistant Commissioner for Patents Box Patent Application Washington, D.C. 20231**

1. [ ] Fee Transmittal Form *(Submit an original, and a duplicate for fee processing)*
2. [X] Specification **Total Pages 34** *(preferred arrangement set forth below)*
   - Descriptive title of the invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to microfiche Appendix
   - Background of the Invention
   - Summary of the Invention
   - Brief Description of the Drawings
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [X] Drawing(s) (35 U.S.C. 113) **Total Sheets 12**
   [ ] Formal [X] Informal
4. [ ] Oath or Declaration/POA **[Total Pages [ ]]**
   a. [ ] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. 1.63(d)) *(for continuation/divisional with Box 17 completed)* **[NOTE Box 5 below]**
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference *(useable if Box 4b is checked)* The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. [ ] Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
      [ ] Pages
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [ ] Assignment Papers (cover sheet & documents)
9. [ ] 37 C.F.R. 3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
14. [ ] Small Entity Statement(s) [ ] Statement filed in prior application, status still proper and desired
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Other: ______

17. **If a CONTINUING APPLICATION,** check appropriate box and supply the requisite information:
[ ] Continuation [ ] Divisional [X] Continuation-in-part (CIP) of prior application No.: 09/456,181
Prior application information: Examiner: Not Assigned Group Art Unit: 2787

18. CORRESPONDENCE ADDRESS

NAME	J. Grant Houston, Esq. HAMILTON, BROOK, SMITH & REYNOLDS, P.C.				
ADDRESS	Two Militia Drive				
CITY	Lexington	STATE	MA	ZIP CODE	02421-4799
COUNTRY	USA	TELEPHONE	(781) 861-6240	FAX	(781) 861-9540

Signature		Date	3/17/00
Submitted by Typed or Printed Name	J. Grant Houston	Reg. Number	35,900

Rev September 23, 1999

Date: 3-17-00 Express Mail Label No. EL290727188US

Inventors: David M. Greschler, Owen Mysliwy, and Stuart Schaefer

Attorney's Docket No.: 2704.1001-003

PORT PROXY METHOD AND SYSTEM FOR SERVER AND CLIENT COMPUTERS

RELATED APPLICATIONS

This application is a continuation-in-part application of U.S. Patent Application No. 09/456,181, filed on December 7, 1999, the entire teachings of which are incorporated herein by this reference.

This application claims the benefit of U.S. Provisional Application No. 60/128,828, filed April 12, 1999 the entire teachings of which are incorporated herein by this reference.

BACKGROUND OF THE INVENTION

Internet or network delivery of application-program-style functionality has become increasingly important. The ubiquitous client-server platform typically requires that the application program code be loaded and installed on the client computers. This requirement, however, is viewed as substantially increasing the installation and maintenance costs associated with computer networks. Moreover, many client operating system platforms are deemed unstable. Network delivery of applications programs would enable the code to be maintained only on the server-side, rather than distributed throughout the network.

Additionally, there are a number of different business models that are pulling for network delivery of application program functionality. First, it can be used in software sales. A web-based software-sales institution can utilize the Internet, or other public network, to allow customers to "test-drive" the programs, and thereby increase sales. A second justification for deployment arises in the thin-client/network-computer model where the code required for the application-functionality and user data reside on the server. In this situation, when required at the thin client, the application code is provided by the server on an as-needed basis. These servers can even be off-site in an application service provider (ASP) environment. Another justification surrounds the possibility to "rent" programs to users. A large number of potential users may have only limited requirements for certain classes of application programs. Their individual requirements may not justify investment in the typically expensive programs or not justify the costs of client installation. The thought here is to enable these users to rent access to the application programs, preferably via the Internet, to generate new revenue streams for the application software companies.

One solution to providing application program functionality to the client computer via the network involves expanding the functionality of the browser. For example, the term "plug-in" is used to describe a browser code extension. ActiveX and Java are two of the most common code platforms for the browser.

While the solution to provide application program functionality via the browser is attractive in its simplicity, a number of problems exist under current technology. First, providing sophisticated ActiveX and/or Java functionality is still in its infancy and largely untried. Further, it ignores the wealth of existing, stable application programs that have been written and are being written to run directly on operating systems, such as Windows 95/98/NT/2000, Unix, Linux, and Mac OS's.

Related, but limited, solutions attempt to allow potential buyers, for example, to "test drive" the program over the internet. Typically, one of two techniques have been used. First, the selling institution may allow the potential owner to download a trial-version of the program. This version may have reduced capabilities and/or a limited lifetime, where the program is disabled after it has been invoked a set number of times, or after a specified date. This process, however, is complex, often requiring a multi-step process in which the user must accept the download, pick a save-as location, watch the download, quit the browser, find the file on the hard drive, and run an installer, for example. Another technique is to extend the potential purchaser's browser in some fashion using, for example, a Java applet. This approach, however, shares the problems discussed previously relative to ActiveX and Java.

Against this backdrop, most modern computer/network operating systems allow for the execution of code that is stored remotely from the client computer. The systems allow a client computer to mount a physically remote drive, residing on a server or peer computer, and execute the application program residing there. Typically, however, these capabilities of the operating system are only utilized within an institution where an umbrella network management exercises control over both the clients and the servers to realize the necessary security levels, prevent corruption of data on the server side, and configure the client computers to access the server-stored code.

SUMMARY OF THE INVENTION

Software players can be defined that will configure the client to communicate with remote storage assets across a network, automatically. The problem is, however, that security policies and institution firewalls may *a priori* block this remote access with these existing networking protocols. Thus, in many environments, they can not be used.

In general, according to one aspect, the present invention features a method for enabling remote networking functionality by port redirection. The method comprises executing a process requiring networking protocol and intercepting communications from the process to a port assigned to support the network protocol. The communications are then redirected over an open port.

In preferred embodiments, the step of executing the process comprises executing an application program on a remote storage asset using SMB networking protocols, with the communications being directed at port 139. This interception can be accomplished by addressing the communications to a local loop back.

To overcome even the most sophisticated firewall systems, the communications are preferably encapsulated an HTTP packet, and specifically a post data portion.

In general, according to another aspect, the invention can also be characterized in the context of a system for remote networking by port proxy. The system comprises an application program executing on a computer which is utilizing the SMB protocol to access a remote storage asset. A port proxy program intercepts communications from the program to a port assigned to support the SMB protocol and redirects the communications over an open port.

The above and other features of the invention including various novel details of construction and combinations of parts, and other advantages, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular method and device embodying the invention are shown by way of illustration and not as a limitation of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale; emphasis has instead been placed upon illustrating the principles of the invention. Of the drawings:

Fig. 1 is a schematic illustration showing the application serving system and specifically the interaction between the target client computer, the host Web server computer of the third-party subscribing institution, and the server system, according to the present invention;

Fig. 2 is a flow diagram illustrating the method by which the serving of applications to the target computer is initiated at the third-party subscribing institution according to the present invention;

Fig. 3 is a flow diagram illustrating the steps performed by the server system when the target computer requests an application;

Fig. 4 is a flow diagram showing the launch process for the helper application, or software player, on the target client computer;

Figs. 5A and 5B are flow diagrams showing the application launch process that is performed on the target client computer;

Figs. 6A-6C are flow diagrams showing the steps associated with the application monitoring process according to the present invention;

Fig. 7 is a flow diagram illustrating the application shutdown process according to the present invention;

Fig. 8 is a schematic block/communication stack diagram illustrating the operation of the SMB proxy application according to the present invention; and

Fig. 9 is a process diagram illustrating the operation of the port proxy.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 shows an application serving system 100, which has been constructed according to the principles of the present invention.

Generally, the application serving system 100 comprises the user, target client computer 110 that connects to a server system 112 and subscribing institution host Web Server 130, over a network 114.

Client computer 110, Web server 130, and server system 112 implement a network protocol layer to communicate across the network. In a preferred embodiment, network 114 is the Internet, or other public or private network, and the network protocol layers are TCP/IP and NetBios. Other network configurations and network protocols layers, however, could be implemented in place or in addition to those associated with the Internet such as those provided in other public or private networks and internetwork systems.

The target, client computer 110 is a PC computer in one implementation. It operates Microsoft Windows 95/98/NT/2000/CE operating system or other OS providing compatible API's (application programming interfaces), on an Intel processor/IBM-compatible hardware platform. Other alternatives, however, are possible such as open source operating system platforms, such as Linux, or Apple MAC OS's or other operating systems that provide the API support for these operating systems. Still further alternatives include embedded OS platforms such as Windows CE and Palm OS's, or similar reduced code-footprint systems.

The target computer 110 preferably has preinstalled application programs. In the present implementation, a browser 134, such as the ubiquitous Netscape Navigator or Microsoft Explorer browsers, is installed. Additionally, the target computer also preferably has a helper application or software player 132. Such pre-installation can be performed typically at a website hosted by the institution that operates the server system 112 or also the subscribing institution 130.

Depending on the institution managing the target computer, a firewall 111 may be present between the target computer and the network 114.

The subscribing institution, which maintains the host web server 130, is typically a third party relative to the institution, which maintains the server system 112 in one anticipated business model. The subscribing institution has a requirement, or desires to provide, application programs and the related functionality to the user at the target computer 110, but, rather than providing this functionality itself, the subscribing institution outsources this to the institution operating the server system 112. Nonetheless, the subscribing institution typically has an Internet presence. Specifically, it typically maintains a website/websites that offer the application programs to users.

From one implementation, the server system 112 is maintained by an institution that provides application programs to users as a paid service to subscribing institutions. Nonetheless, it should be appreciated that the technology of the present invention also has applicability to the business model where the server system 112 and host Web server 120 are maintained by the same institution. In this context, the institution does not wish to out-source the work associated with the serving of the applications, but wishes to provide this functionality through in-house expertise.

Specifically the service institution's server system 112 maintains a log-in database 116, a customer database 118, an application database 120, and a current sessions database 122. The server system additionally executes a session ID generator 124, a load balancing process 126, and an encryption process 128.

Fig. 2 shows the steps performed by or at the target computer 110 to initiate the serving of an application from the server system 112. Specifically, a user at the target computer identifies a desired application to the target computer 110 in step 210. In the

typical case, the browser 134 is executing on the target computer 110 and a link is displayed in the browser window. This link is identified and/or associated with the application that the user desires to execute on the target computer. The user, operating a graphical pointing device, such as a mouse, controls the target computer's graphical user interface to select or "click-on" the link for the desired application.

Selection of the link in step 210 causes the browser 134 to interrogate the target computer's operating system to determine whether the appropriate software player (SWP) has been installed on the target computer in step 212. This interrogation is performed in one embodiment by an application programming interface (API) call to check the operating system registry. Applets, ActiveX, or scripting, however, are other modalities for performing the interrogation.

If it is determined that the software player has not been installed on the target computer 110, an installation process is initiated in step 214. In the typical implementation, this installation process comprises either pointing the browser 134, or a new instantiation of the browser, with a new universal resource locator (URL), to website that supports the installation of the software player through a download, for example.

The install/download is simplified for ease of operation. In one implementation, a Java applet is used that allows installation and writing to the drive--if permission is provided. A download bar is displayed on the browser screen. When the player 132 has been installed, it begins to run and will launch the application that was initially requested by the user. As a result, the user at the client computer 110 observes the invocation of the application, rather than the software player alone.

Once there is an installed software player, the browser 134 is pointed with a URL to the server system 112, in step 216. The URL link contains: 1) a unique identifier, or number, associated by the server system 112 with the application requested (TitleId); 2) a unique session ID (SID); and 3) an identifier that identifies the subscribing institution (SubInstId). Typically, the subscribing institution is the company that operates the host Web server computer 130, which served the web page that originally contained the link associated with the application that was desired by the user of the target computer 110.

The SID is a unique session ID that is specific to the link and the specific session. A session ID that served as part of the original link provides a token from the web site that tells indicates that the subscribing institution has authenticated this specific session. This is important for the rental/subscription model where they will be authenticating users with credit cards or user names and passwords.

Fig. 3 shows the steps performed by the server system 112 when the target computer 110 requests an application by transmitting the URL containing the SID, TitleId, and SubInstId to the server system 112 over the network 114.

Specifically, in step 310, the server system 112 receives the URL, SID, TitleId, and SubInstId. The server system then accesses the log-in database 116 to verify that: 1) the user at the target computer 110 is a valid user by reference to the session Id field (SID); and 2) the subscribing institution is a currently valid subscribing institution by reference to the SubInstId field in step 312. If either the user or subscribing institution is invalid (step 314), an error is returned to the target computer 110 in the step 316 by the server system 112.

If the user and subscribing institution are verified, the server system 112 then proceeds to construct an application descriptor or data file that will coordinate the operation of the target computer 110 and the server system 112 across the network 114. In the present implementation, the application descriptor is a file that is named with a ".WOW" suffix, which is the MIME type.

Specifically, in step 318, the server system 112 accesses the customer database 118 using the SID to obtain information regarding the session.

Next, in step 320, the application database 120 is accessed. This contains information concerning the application, which was requested by the user. For example, the application database 120 contains information such as minimum system requirements (RAM, processing power, etc.) that are required by the application on the target computer 110 and the application's media weight or processing requirements on the server system 112 associated with each instantiation.

In step 322, the load balancing process 126 is executed. The server system 112 selects a host computer within the server system that will be primarily responsible for serving the application over the network 114 to the target computer 110. In the typical embodiment, the server system comprises multiple host Web and associated application servers. The selected host computer is co-located with the other host computers in one implementation; alternatively, components or servers of the server system are located in a server farm and/or geographically local to the target computer 110. In this last case, the load balancing process selects the host computer based on geographic proximity, in addition to load, to reduce latency.

Typically, the load balancing checks the current session's database 122 to determine which host server in the server system 112 has the least load. The list of

servers serving the specific application is part of the title's application description. Determination of which server to use is based on the number of concurrent connections to each server and the media weight of each application and also the user's physical geographic location based on the IP address.

Next, in step 324, the current sessions database 122 is updated in step 324 with the current session being added. Specifically, the session ID, the user's IP (internet protocol) address, the application title, the media weight, and the server assigned to the session is added. This database is used by the load balancing process 126, and by a watch dog process that watches the connections to each host server in the server system, to verify that all connections are from authorized users.

In step 326, the application descriptor is encrypted. Minimally, this application descriptor comprises the host address of the host computer of the server system 112, which was assigned by the load balancing process 126 along with a session ID assigned as part of the update of the current session database 122. Finally, the application descriptor is sent to the target computer 110 in step 328.

Fig. 4 shows the launch process for the helper application or software player 132.

Upon receiving the .WOW application descriptor file, the client launches the software player 132 in step 409. This is a helper application that performs the bulk of the client-side application management.

In the preferred implementation, the receipt of the .WOW descriptor file automatically launches the software player. This is accomplished by configuration of MIME types during the software player's initial installation. In the Windows 95

operating system, MIME types are set in the registry, associating files with a specified suffix, here: WOW, that are to be opened with the software player 132.

Many of the methods used employ Windows API Functions to control the executed applications. In one embodiment of the invention, the Buddy API Xtra (a library of calls employed by programmers of Macromedia Director) is used to access Windows API functions. Specifically, the initial writing to the registry is done with the baWriteRegNumber and baWriteRegString commands in Buddy API.

In step 410, the registration status of the software player 132 with respect to the server system 112, or institution operating the system, is determined. If it has not been registered and/or properly licensed, a registration box is displayed on the graphical user interface of the target computer 110 in step 412. The user is either requested or required to complete the registration information box, depending on the implementation. Once completed, the registration information is sent, in step 414, to the server system 112 over network 114.

After registration, the status of any firewall proxy for firewall 111 is interrogated in step 416. If it is not valid, a proxy information dialog box is displayed in step 418, and the user is requested to complete it on the target computer 110. Once completed, the proxy information is updated in step 420.

Next, the status of the application descriptor, or WOW file is interrogated in step 422. If no application descriptor file is detected, a dialog is generated in step 424, on the target computer 110 for the user. The user is requested to enter a partner or subscribing institution. If it is determined that no institution has been entered in step 426, the process aborts. However, if a subscribing institution was entered, the process

similarly aborts in step 430, but also points the browser 134 to the Web page for the subscribing institution in step 432.

Next, 434, it is interrogated as to whether the client is monitoring a similar process, *i.e.,* the software player 132 is currently running on the client. If it is not running, the SWP window is created in step 436. Depending on the run mode, the window is either hidden or visible on the client interface. In step 438, any system clean-up is performed. Generally, the operating system registry is written to when applications 133 are run. The software player tracks those modifications, and any registry changes; these changes are undone when the application 133 and software player 132 are quit. However, if the software player 132 was terminated unexpectedly during its last operation, the registry clean-up may not have been performed. If not, the clean-up occurs in this step. Specifically, any modified registry settings are returned, icons are removed, folders in any disk drive are removed, and any new copies of applications on the desktop are removed. Next, the player is set up on the OS tray. Finally the port proxy application is started in step 442 prior to the application launch process in step 450 in the preferred embodiment.

Generally, the port proxy application is required because of the preferred embodiment of the present invention utilizes standard Microsoft Windows 95/98/NT/2000 operating system networking protocol implementation of SMB (server message block), the functionality of which is blocked on may client computers. This standard protocol operates over port 139. However, since it is a sharing protocol, it is deemed dangerous or non-secure, and communications through this port are blocked by many commercial, government, and/or corporate firewalls.

The use of the port proxy is not limited only systems using the SMB protocol, but is deploy in any environment where the port and or network communications

protocol used by the player is blocked, or possibly blocked, on the client computer. Generally, the port proxy enables a protocol to be redirected to another port such as HTTP or web ports.

If it was determined that the SWP is currently monitoring a process and thus invoked, in step 444, the status of the target computer operating system is interrogated in step 444. If too many applications are currently running, a dialog is generated notifying the user in step 446 and the process aborts in step 448. However, if there is sufficient resources to run the application, the new launch application process is started in step 450.

Figs. 5A and 5B show the application launch process.

Specifically, the software player 132 reads and decrypts the incoming application descriptor WOW file. To read in the encrypted data, the program uses the baCommandArgs command in the Buddy API. The decryption of the commands is done via the baDecryptText command in the Buddy API.

Once decrypted, the software player 132 checks to see if this is the first time it has been run on the client computer 110 by checking the computer's internal settings to see if a unique ID has been written to the settings. This is done via the baReadRegString command in Buddy API. If it finds the unique ID, it continues. If it does not find a unique ID, it asks the user for personal information that will be collected for a User Database, in one exemplary implementation.

It then creates a WOW data struct in step 510. The version of the application descriptor is then compared to the version of the software player 132 in step 512 to ensure compatibility. If there is no compatibility, a dialog is displayed in step 514

asking the user if they wish to upgrade to a new software player. If the user agrees to upgrade, the new dynamic link libraries (.DLL files) are downloaded from the server system 112 in step 516. The software player unloads the current dynamic link libraries and updates the DLL's in step 516.

In contrast, if the user chooses not to install the new software player in step 514, the process aborts in step 518, while simultaneously pointing the browser 134 with an upgrade URL to a site hosted by the server system 112 or hosted by another server in step 520.

If the process is not aborted, in step 518, the application requirements contained in the application description are compared to the target computer's configuration in step 522. If there are inadequate resources, the process aborts in step 524. Additionally, the browser 134 is pointed toward a web page hosted by the server system providing for maintenance. Specifically, the maintenance URL is passed to the browser in step 526. For example, a minimum or maximum screen depth, resolution, RAM requirements, processor requirements, sound board requirements, and video board requirements are assessed. These checks are supported by the following commands in Buddy API: baVersion("os"), baVersion("qt"), baVersion ("qt3"), baScreenInfo("height"), baScreenInfo("width") and baScreenInfo("depth").

If the user system's resources are determined to be adequate in step 522, a message is sent from the target client computer 110 to the server system over the network 114 in step 528. The message contains the session ID, which was just received from the server system in the application descriptor file. Also, a start request message is sent to the server system. The receipt of the session ID identifies the session and implicitly notifies the server system 112 that the target computer has successfully decrypted the application descriptor file, which had been previously sent. The start

request indicates that the target client computer is now ready to begin to execute the requested application.

Also, the software player 132 preferably determines, via the application descriptor, the transaction mode being used. This will impact the appearance of the player 134 on the screen or GUI of the computer 110. For example, if the application descriptor identifies itself as an advertisement-based transaction (noted as an "a" in the Application Descriptor), then the software player 132 will respond by positioning itself at the top level of the screen depth and begin to request advertisements from an advertisement server, within the server system 112, over the network 114. Conversely, if the application descriptor identifies itself as a subscription-based (noted as an "s" in the application descriptor), the software player 132 will hide itself, but continue to execute in the background. To hide itself the program uses the baWindowState command in Buddy API. The ads are obtains through hypertext transfer protocol (http) calls.

In step 530, the target client computer 112 then waits for a start request acknowledgment from the server system 112. If no acknowledgment is received after a predetermined time period, a dialog is displayed on the target client computer 110 to notify the user that the server system is currently unavailable in step 532.

If the start request is acknowledged in step 534 by the server system 112, a proxy socket is opened in the target computer 110 and the application server address is passed to the proxy in step 536.

Continuing onto Fig. 5B in step 538, the software player 132 determines if any files are required from the server system 112 to continue the launch process. If additional files are required, they can be obtained by initiating a remote drive mounting

process in step 540. Alternatively, the files can be obtained using a local file installation and replace process in step 542. Additionally, both processes could be used if multiple files are required.

Certain applications require specific files at specific locations. For example, certain anti-virus programs require virus definitions to exist at specific path. Such hard coded path requirements are addressed in this initial configurations check. A file check is performed and any required files are shipped to the client computer before the application is launched.

With the remote drive mounting and possibly local file installation/replace, the target client computer 110 now has access to the files and specifically the code required to invoke the selected application. Next, in step 544, the directory is set to the local or remote drive and the run command is issued to the host server. In one embodiment, this occurs on port 139, the SMB port, from the perspective of the application, but is actually sent through port 80 by the proxy application. Specifically, standard Windows NT remote networking methods are used to attach to the server's directory using the Net Use command, which is part of the Windows Networking.

If the client computer is running the Windows 95-version operating system, there is an additional step taken here. Since Windows 95 computers need to have the name of the server they are attaching to in a file in the Windows directory called LMHOST; the software player 132 writes the name of the server to the LMHOST file using the FileI/O command in Macromedia Director.

The software player 132 then waits for the application window and the update of the stream display in step 548. The window status is acquired by reference to the operating system application programming interface. In the preferred embodiment,

where it is operating on a Windows OS platform, the window status is obtained via the WIN API in step 550. The stream data size is obtained from the proxy application in step 552.

In step 554, it is interrogated as to whether or not the application window has opened. Until the window opens, the host server in the server system 112 is periodically pinged. The window timeout is reset as many as three times and as long as the server is responsive to the ping in step 558. If there is no server response to the ping as determined in step 556, the user is notified via the dialog in step 560 and the program aborts in step 562.

If, however, the window opens as determined in step 554, the user interface elements are activated that are specific to the application in step 564. The size and position of the software player and application windows are then set in step 566. At this stage, with the application running on the operating system of the target client computer 110, the process proceeds to an application monitoring in step 568.

In the preferred embodiment, there are six processes that are performed to monitor the application. Application window monitoring, tracking pulse monitoring, advertising updating, net traffic monitoring, count-down timing, and user event handling.

Fig. 6A illustrates the steps associated with application window monitor process and the tracking pulse process.

Specifically, while the selected application is executing, the client computer multitasks to also monitor the operation of the application. One of the processes is the application window monitor process 610. Specifically, the application window monitor

process 610 periodically makes API calls to determine whether or not the application's window is still open in step 612. If the window is open, it continues to maintain and/or set the position and layer of the windows of the application 133 and the software player 132 with respect to each other in step 614 according to the transaction mode. However, if the application window monitor process 610 determines that the application window has closed, the software player 132 begins the execution of a shutdown process 616.

The tracking pulse process 618 periodically sends a pulse or a ping to the host server of the server system 112 in step 620. If it is determined that no pulse has been received in step 622, the target client computer 110 pings the host server of the server system in step 624. Based on the status of the ping, if it is determined that there is no connection to the server, a dialog is generated in step 626 and there is a forced shutdown of the application process in step 628, and again, the shutdown process is activated 616. If the ping is successfully sent to the server, but no response is received, a dialog is generated in step 628. Again, a "no response" dialog is generated in step 630 and the shut down process is activated in step 616.

In other implementations, tracking is not provided by sending pulses; instead, the application server monitors socket connections to determine if connections are still active. From the client side, instead of the server telling the client to shut down, the client gets its "total time to run" as part of the .wow file and begins counting down -- and eventually shuts down -- once it hits zero time.

In contrast, if it is determined that the pulse is received in step 622, the message is analyzed. If it is determined that the message is to turn off the application in step 632, the application process is terminated in step 628 and the shut down process is activated, step 616.

If the message returned that the application must be terminated within n minutes, a dialog is generated in step 634, notifying the user of the remaining minutes of access to the application. A countdown timer is started in step 636. Finally, if the message returned is an all clear or o.k. message in step 632, process returns.

Fig. 6B shows the advertisement update process, net traffic monitoring process, and countdown timer process, which are additionally performed as part of the application monitoring.

Specifically, the ad update process periodically updates the ads displayed on the software player and any URL's required for the ad server in step 640. It then returns to the run mode of the ad process in step 642.

If the transaction mode is advertisement-based, the software player will maintain a +1 depth relationship with the application's window. This means that if the application 133 is brought to the front, the software player 132 will place itself in front of the application 133 so the application cannot hide the advertisements being served. If a different application or window, *i.e.,* one not being hosted by the server system 112, is brought to the front, the software player 132 will not obscure the application or window. It will maintain its +1 depth relation to the application 133. This is accomplished via the baWindowDepth command in Buddy API. Also, the player is monitored so that it is not moved off the screen.

Step 644 monitors network activity and notifies the net traffic monitoring process in step 646. This allows the application monitor to determine if there are any problems associated with high traffic, which would impact the operation of the application.

In step 648, the display countdown timer is updated. This countdown timer notifies the user as to the time remaining in which the application is available. This is most relevant where the user has, for example, "rented" the application for a fixed period of time as indicated by the transaction mode. The countdown timer updates the countdown timer process 650 so that a shut down process is automatically activated when the timer has timed-out.

Fig. 6C illustrates event handling process 652 of the application monitoring processes. Specifically, if the bookmark is selected in step 654, the URL of the third-party application hosting institution and its server system 112 is added to the start menu folder of the browser 132.

Currently, the bookmarking feature is termed"Quick Launch" -- instead of adding it to the start menu folder system, it gets book-marked as part of a screen in the player -- the one that comes up if you click on Quick Launch. It remembers the location from where you initially clicked, thus guaranteeing the web site that they will still get ad revenue and a follow-up page each time the user clicks on the Quick Launch bookmark.

If the help button is selected in step 656, a help file is displayed. The browser 134 is pointed to a URL of a help file server in step 658. If the third party home is selected in step 660, the browser is pointed to the URL or a specified URL of the subscribing institution in step 662. If the home button is selected in step 664, the browser 134 is pointed to the home page of the third-party application hosting system in step 666. If the ad, which is displayed by the player, is selected in step 668, the browser is pointed to the URL of the advertising company in step 670. Finally, if the quit button is selected in step 672, the application is forced to terminate in step 674 and the shutdown process is started in step 676.

Fig. 7 is a flow diagram illustrating the application shutdown process. Specifically, if the application 133 is desired to be shutdown or quit in step 710, a shutdown pulse or signal is sent from the client computer 110 to the host server of the server system 112 in step 712. Any remnants of the application program are then removed from the operating system 135 and local drives generally, in step 714. . Specifically, any modified registry settings are returned, icons are removed, folders in any disk drive are removed, and any new copies of applications on desktop are removed. Next, the player 132 is set up on the OS tray.

Finally, in the preferred embodiment, a follow-up URL is sent to the browser 134 in step 718. In the preferred embodiment, this follow-up URL is for the subscribing institution and is typically hosted by the web server 130, allowing it to follow with a "sales pitch" or to solicit for further purchase of goods and/or services. This allows, in some implementations, the third-party application hosting to be transparent to the user at the target computer. Finally, any remaining monitoring processes are identified in step 720, and the monitoring processes are terminated in step 722.

Finally, in step 724, the proxy application is quit and the software player is shut down in step 726.

Fig. 8 illustrates the operation of the port proxy of the software player 132. According to the preferred embodiment, when the application 133, through the software player, makes request to server system 112, the request is directed to port 139 as a standard SMB communication by the application. This SMB communication is intercepted by the SMB proxy of the software player 132. The request is redirected, by the proxy, through port 80, which is the http, or web port or some other open port such as the FTP port.

The SMB protocol has been in use on corporate LAN's (local area networks) for nearly twenty years. In that time, it has become a popular vehicle for enabling simple networking. It is at the heart of Microsoft Networking and also in IBM's OS/2. For historical, practical, and security reasons, it has remained a LAN based, however .

Microsoft networking utilizes the SMB protocol to communicate between PC clients and servers to provide file sharing, print sharing, and basic network authentication. Most commonly this is wrapped in the NetBIOS protocol to enable plug and play networking for small, medium and large LANs. The NetBIOS protocol provides for auto-discovery of networks, machine addressing abstraction, and decentralized management of networks.

For ease of use reasons, NetBIOS has grown to be a common standard on corporate LAN's. However, this also presents a significant security risk. A hacker who has broken into or is seeking to break into a corporation's LAN can either wait and "sniff" to find addresses of machines on the LAN, or a smart hacker can broadcast spurious NetBIOS packets and discover the formation of the LAN automatically.

In addition, early implementations of SMB transmitted usernames and passwords without encryption or other security across the LAN. This has since, however, been discovered and patched.

As a result of these two situations, most corporations block traffic to and from the Internet which uses the NetBIOS protocol. This is typically accomplished at the firewall because the frames identify the port from which they originated. The firewall stops frames based upon their port origination.

According to request for comments (RFC) 1001/1002, TCP and UDP ports 137,

138 and 139 are used for enabling a NetBIOS-based service. Microsoft Networking is such a service, wrapping the SMB protocol with NetBIOS for name resolution and other services. Therefore, all Microsoft Networks behind firewalls or proxies most commonly block these ports to guard their LANs from intrusion. In addition, many ISP's today block this traffic as well, to protect their user's from malicious Internet hackers.

In addition, most corporations have by default blocked all traffic to and from the Internet with only minor exceptions like HTTP, FTP, SMTP and POP3, protocols, which have become a staple in job performance. Therefore, it can be expected that to guarantee provision of any service across corporate firewalls, the use of HTTP as a carrier is the only choice. Though there are many other options, such as SOCKS proxies, or HTTP tunneling, use of standard HTTP over port 80 is preferred.

The proxy of the software player 132 listens for requests for port 139. These are transferred using address 27.0.0.1, which is the address for a loopback. The client computer 110 then monitors this local-loopback address.

Generally, there are three levels of firewalls. Minimally, most firewalls do not route anything from port 139. As a result, if the transmissions are sent through port 80, they can pass through this type of firewall. Even in more secure firewalls, port 80 is typically open. In the most secure type, the firewall blocks port 80, but proxies communications on this port. To handle this last configuration, the SMB communication is preferably encapsulated within an http packet, HTTP(SMB packet). As a result, an http header is added, which comprises a request line followed by a post form-data tag. These types of headers are used when data from a form is typically sent to a script process. For the http post to be performed correctly, the content length, content type, and MIME type are also set.

At the other end of the network, a web server 810 of the server system 112 listens on the corresponding port for the communications. It received the http packet with the post data commands. It strips off the packet's header and then sends the post data to the application server as SMB packets. Thus, the SMB proxy allows to the application 133 to execute as if it were mounting a standard Window NT server using the SMB protocol. Communications, however, are actually occurring over port 80 of the client computer 110.

More specifically, the web server 810 receives and maintains the connection with the client computer over the network. Incoming upload HTTP communications are received and the post data stripped out. This data is then transferred to the application server 812 as SMB protocol communications. The download path is handled by the inverse process where the application server sends SMB packets to the web server, which encapsulates the packets into the post data section of an HTTP packet. The HTTP packet header is then established, and the packet is transmitted to port 80 of the client over the intervening networks.

Alternatively, the proxy application on the client can be rerouted through port 23 (FTP) with the server returning on port 21, also reserved for FTP transfer, in another embodiment, if those ports are open.

If the web server 810 is not used, the use of the SMB proxy and port 80 communications requires that the operating system of the host application server in the server system be non-standard. In the one implementation, the server code has been recompiled to support SMB communications over port 80 instead of port 139. This necessitates the use of open source operating systems that implement Standard Microsoft Windows 95/98/NT/2000 protocols.

Fig. 9 illustrates the port proxy process.

Client 110 computer will request a file from a server by making a request in the form of \\COMPUTERNAME\SHARENAME. The COMPUTERNAME is a 15 character mnemonic for some machine in the user's network. The client PC will then try to resolve the COMPUTERNAME into a MAC address /IP address for the destination computer. This is done through a series of measures. First, the client will check its name cache for a pre-existing entry. Then it will try to resolve the name via broadcast to the network for any machine responding to this name or response from a machine which has already resolved this name. As a last fallback, the computer will check a special file, the LMHOSTS file, for a hard coded address.

This process generates a small amount of LAN traffic, which if the remote computer is not on the local LAN, will most likely be blocked by the firewall. This traffic constitutes the requests on ports 137 and 138 TCP and UDP. In the present embodiment, the software player 132 uses the LMHOSTS file to preload the name cache of client computer to avoid the network requests for name resolution in step 910.

The next phase is called NetBIOS Session Setup in step 912. During this phase the PC client will establish a connection to the remote computer, COMPUTERNAME, using the default, pre-assigned port, 139. In the case of Microsoft Networking, SMB is then used to establish a connection to SHARENAME and gain the files requested.

The NetBIOS Session Setup request is retargeted. This means that a valid response to a NetBIOS Session Setup is the IP address and port of a different machine which serves the information sought by the client computer 110. Using a small program, an entry is made into the LMHOSTS file designating the local loopback interface, 127.0.0.1, be given the NetBIOS name SWOWREDIR, in step 914. All

requests then to \\SWOWREDIR\SHARENAME are redirected on the fly to the machine designated by the software player 132. Also, the request can be retargeted to use the FTP control port, 21. This enables further penetration of many corporate firewalls.

The NetBIOS session is preferably proxied as described. Specifically, the port proxy of the player 132 listens again to the loopback interface under the name SWOWPROXY in step 916. Then any request to \\SWOWPROXY\SHARENAME are relayed to address of the server system 112 over port 21 in step 918.

First, however, the NetBIOS session is preferably wrapped in HTTP in step 917. The port proxy, rather than simply relaying packets, queues up a request until a predetermined point is reached. The current accumulated data is then sent to the server system in the form of an HTTP POST transaction.

In this final case, NetBIOS and SMB packets are not simply relayed. The port proxy of the player 132 assembles the SMB packets into requests. The proxy will queue up a request until it is complete, then forward it in its entirety to the other end of the HTTP connection, a server side HTTP proxy.

In the case of the client, the proxy will read the first four bytes of an SMB request. This determines the number of bytes which are to follow and the actual SMB/NetBIOS command. Each request is then read to completion and then transmitted using the HTTP protocol to the server side proxy. The format of this transmission follows an HTTP POST transaction as this example shows:

Outgoing SMB request:

0x85 0x00 0x00 0x00 (SMB Keep Alive)

Proxy intercepts and resends as:

```
POST /cgi-bin/send.cgi?123456789012 HTTP/1.0
User-Agent: Mozilla/4.0 (compatible; SoftwareWow; 1.0)
Accept: */*
Accept-Encoding: gzip
Accept-Language: en-us
Pragma: no-cache
Host: www.softwarewow.net:80
Content-type: multipart/form-data; boundary=--------------------------
YYYYMMDDHHMISS
Content-length: 201

----------------------------YYYYMMDDHHMISS
Content-Disposition: form-data; name=""command""; filename=""
Content-Type: application/octet-stream

0x85 0x00 0x00 0x00
----------------------------YYYYMMDDHHMISS
```

In this above case, the code 1234567889012 represents a unique session identifier used by the server side proxy to track the HTTP connections between requests. The actual URL is irrelevant, but is used to detract hackers from prodding at

the server. If a request is made for an alternate URL, a 404 Not Found response is sent by the server side proxy. The next 6 lines of HTTP are used solely to adhere to HTTP standards, without these lines many proxy servers will ignore the request, deeming our proxy not to be a valid web browser.

The next two lines, Content-type and Content-length identify that what is to follow is a series of MIME encoding postings that the web server will know how to deal with. The Content-length is vital, without it most proxies will delay the request, not knowing when it has ended. Additionally, YYYYMMDDHHMISS represents a time stamp used to simply increment and vary the boundary stamp used in the MIME encoding as per RFC requirements.

If the target computer 110 is behind an HTTP proxy/firewall, the first line will be rewritten as follows instead to accommodate the requirements of the HTTP proxy:

POST http://www.softwarewow.net/cgi-bin/send.cgi?123456789012 HTTP/1.0

The server side proxy on the web server 810 will parse this input and strip out the SMB Keep Alive packet, and transfer it to the SMB server 812 in step 922 . Once a full packet is received from the SMB server in step 924, the HTTP server side proxy will transmit the response as follows:

HTTP/1.0 200 OK
Date: Mon, 13 Mar 2000 20:50:15 GMT
Server: SoftwareWow 1.0
Connection: close
Content-type: application/octet-stream
Content-length: 4

0x85 0x00 0x00 0x00

This response identifies a return of an SMB Keep Alive to the client PC. The server must respond in the first line with a valid response code, 200 represents a valid transaction. Then the server will respond with MIME identification of the type and size of response. On the response, no MIME boundaries are required if the server is solely sending back one packet of type application/octet-stream, which identifies a binary object is being returned. The client SMB proxy will then parse the number of bytes specified in the Content-length header and return these to the true SMB client, closing its connection to the HTTP proxy server.

As HTTP connections are stateless and incur a full TCP setup time to establish, it is an often used practice to utilize an HTTP/1.1 feature called HTTP Keep Alive. As a further enhancement to the above protocol, the SMB proxy could maintain its connection with the HTTP proxy and send multiple requests down the socket. This practice is covered in the HTTP/1.1 RFC.

While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention encompassed by the appended claims.

CLAIMS

What is claimed is:

1. A method for enabling remote networking functionality by port proxying, the method comprising:

    executing a process requiring a networking protocol;

    intercepting communications from the process to a port assigned to support the network protocol; and

    redirecting the communications over an open port.

2. A method as described in Claim 1, wherein the step of executing the process comprises executing an application program.

3. A method as described in Claim 1, wherein the step of executing the process comprises executing an application program residing on a remote storage asset.

4. A method as described in Claim 1, wherein the process utilizes SMB networking.

5. A method as described in Claim 1, wherein the step of intercepting communications from the process comprises intercepting communications for port 139.

6. A method as described in Claim 1, wherein the step of intercepting communications from the process comprises addressing the communications to an address assigned for local loop-back.

7. A method as described in Claim 1, wherein the step of redirecting the communications over the open port comprises encapsulating the communications in an HTTP packet.

8. A method as described in Claim 7, wherein the communications are located in a post data portion of the HTTP packet.

9. A method as described in Claim 1, wherein the open port is an HTTP port.

10. A method as described in Claim 1, wherein the open port is a FTP port.

11. A system for remote networking by port proxy, the system comprising:

an application program executing on a computer which is utilizing the SMB protocol to access a remote storage asset; and

a port proxy program that intercepts communications from the program to a port assigned to support the SMB protocol and redirects the communications over an open port.

12. A system as described in Claim 11, wherein the open port is an HTTP port.

13. A system as described in Claim 11, wherein the open port is an FTP port..

14. A system as described in Claim 11, wherein the SMB port is port 139.

15. A system as described in Claim 11, wherein the communications are

addressed for local loop-back.

16. A system as described in Claim 11, wherein port proxy program encapsulates the communications in an HTTP packet.

17. A system as described in Claim 16, wherein the communications are located in a post data portion of the HTTP packet.

PORT PROXY METHOD AND SYSTEM FOR SERVER AND CLIENT COMPUTERS

ABSTRACT OF THE DISCLOSURE

A method and system for serving software applications to remote clients across the internet, for example, is disclosed that preferably utilizes standard, SMB (server message block), protocols, which are available in commercial operating systems. Further, an associated business method is described in which subscribing institutions can out-source the application serving to a third party institution, transparently. Finally, a port proxy system is provided that enables tunneling through firewalls that are configured to block communications from SMB ports.

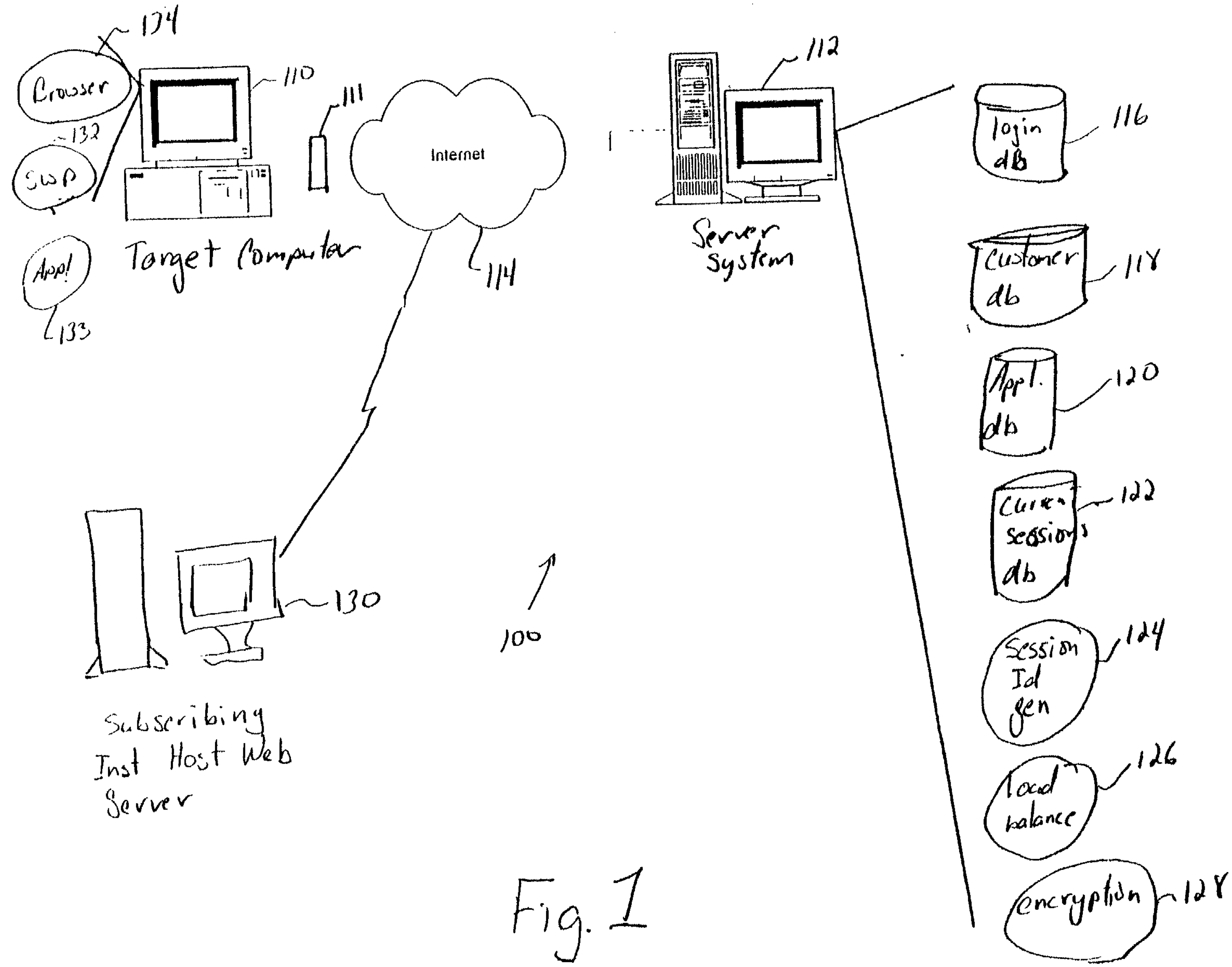

Crowser
134
SWP
132
App!
133
110
111
Target Computer
Internet
114
112
Server System
login db
116
Customer db
118
Appl. db
120
Current sessions db
122
Session Id gen
124
load balance
126
encryption
128
130
Subscribing Inst Host Web Server
100

Fig. 1

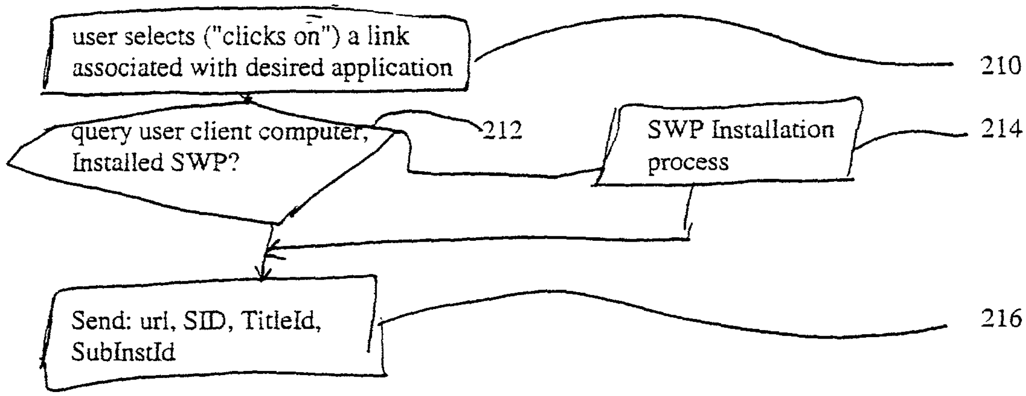

user selects ("clicks on") a link associated with desired application
210
query user client computer, Installed SWP?
212
SWP Installation process
214
Send: url, SID, TitleId, SubInstId
216

Fig 2

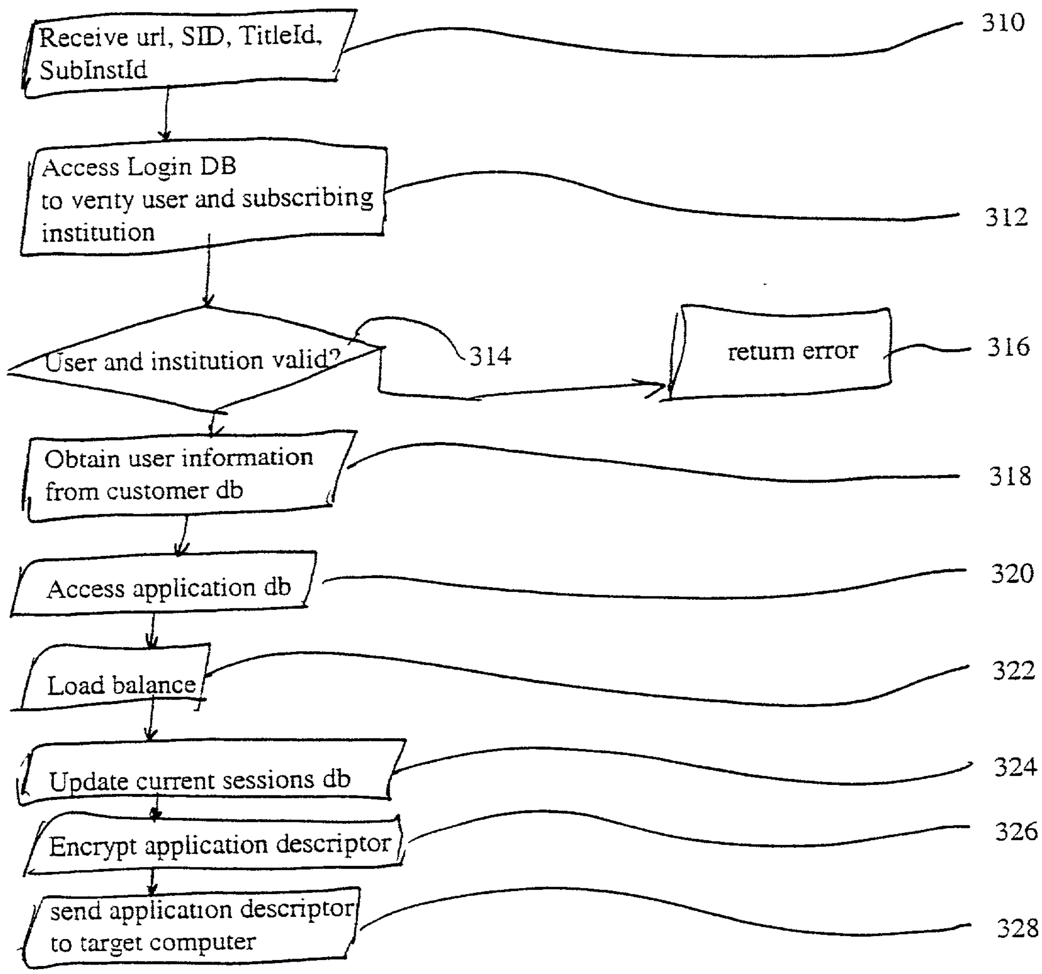
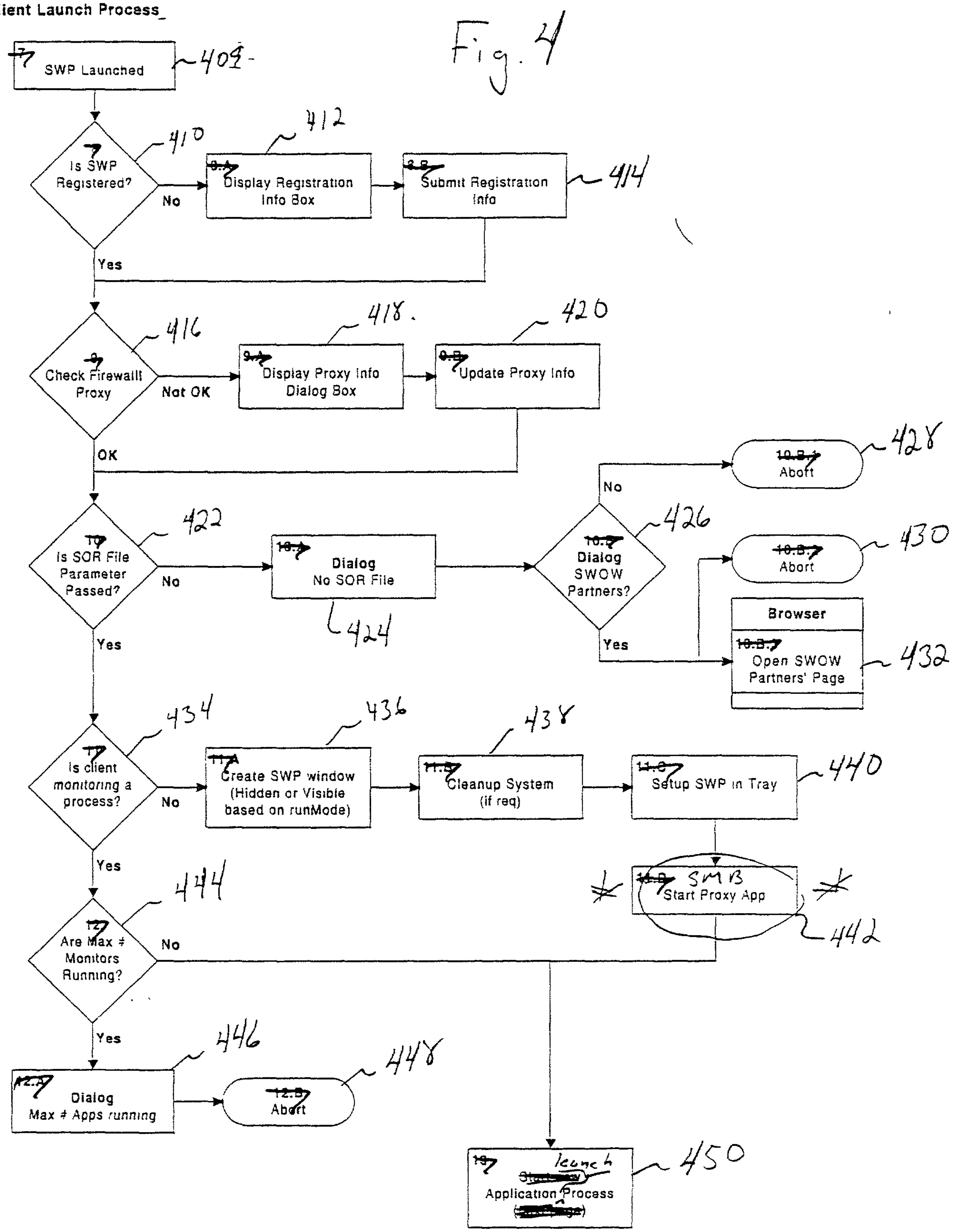

Receive url, SID, TitleId, SubInstId
310
Access Login DB to verity user and subscribing institution
312
User and institution valid?
314
return error
316
Obtain user information from customer db
318
Access application db
320
Load balance
322
Update current sessions db
324
Encrypt application descriptor
326
send application descriptor to target computer
328

Fig. 3

Client Launch Process

Fig. 4



Application Launch Process (1/2)

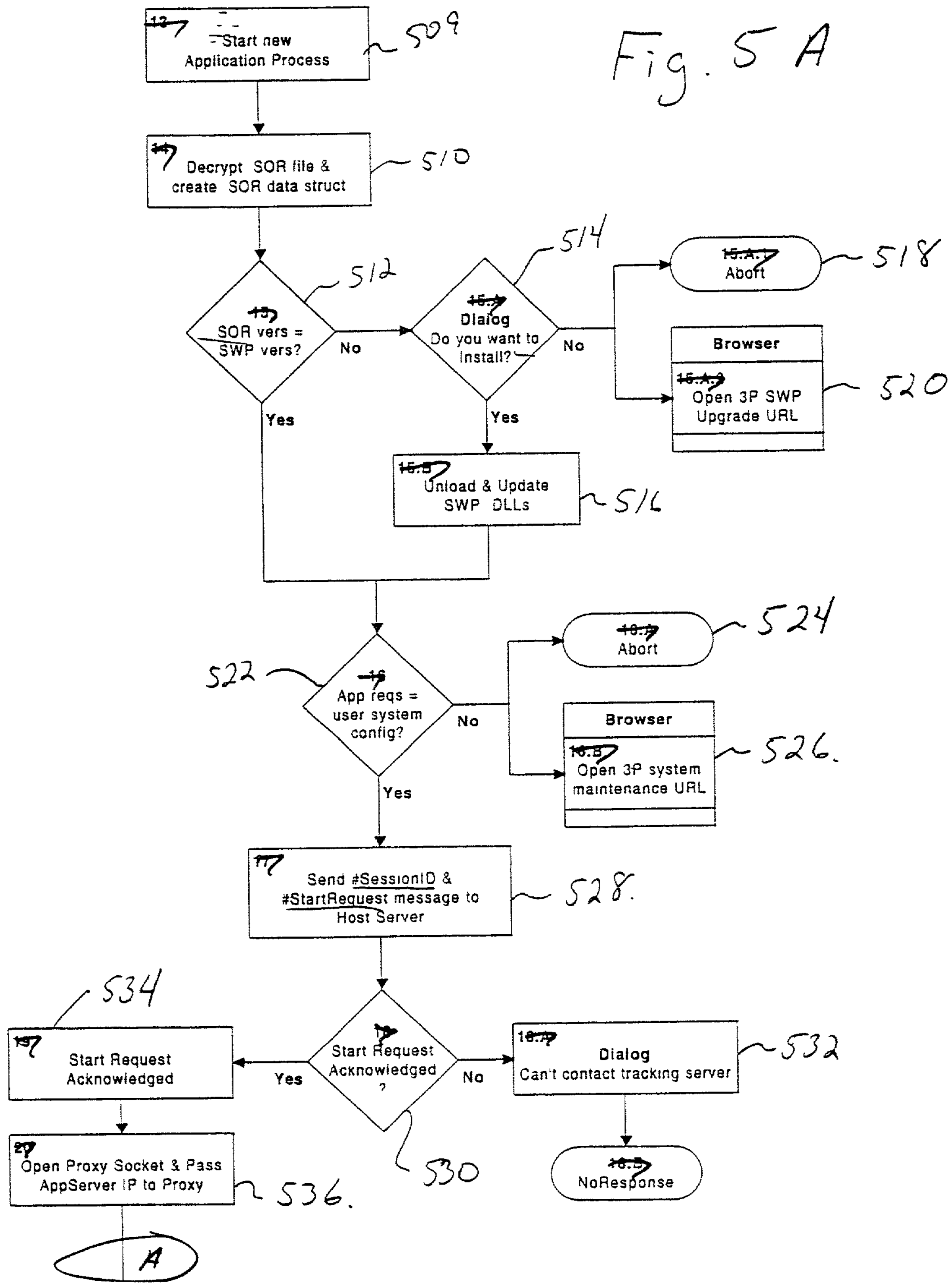
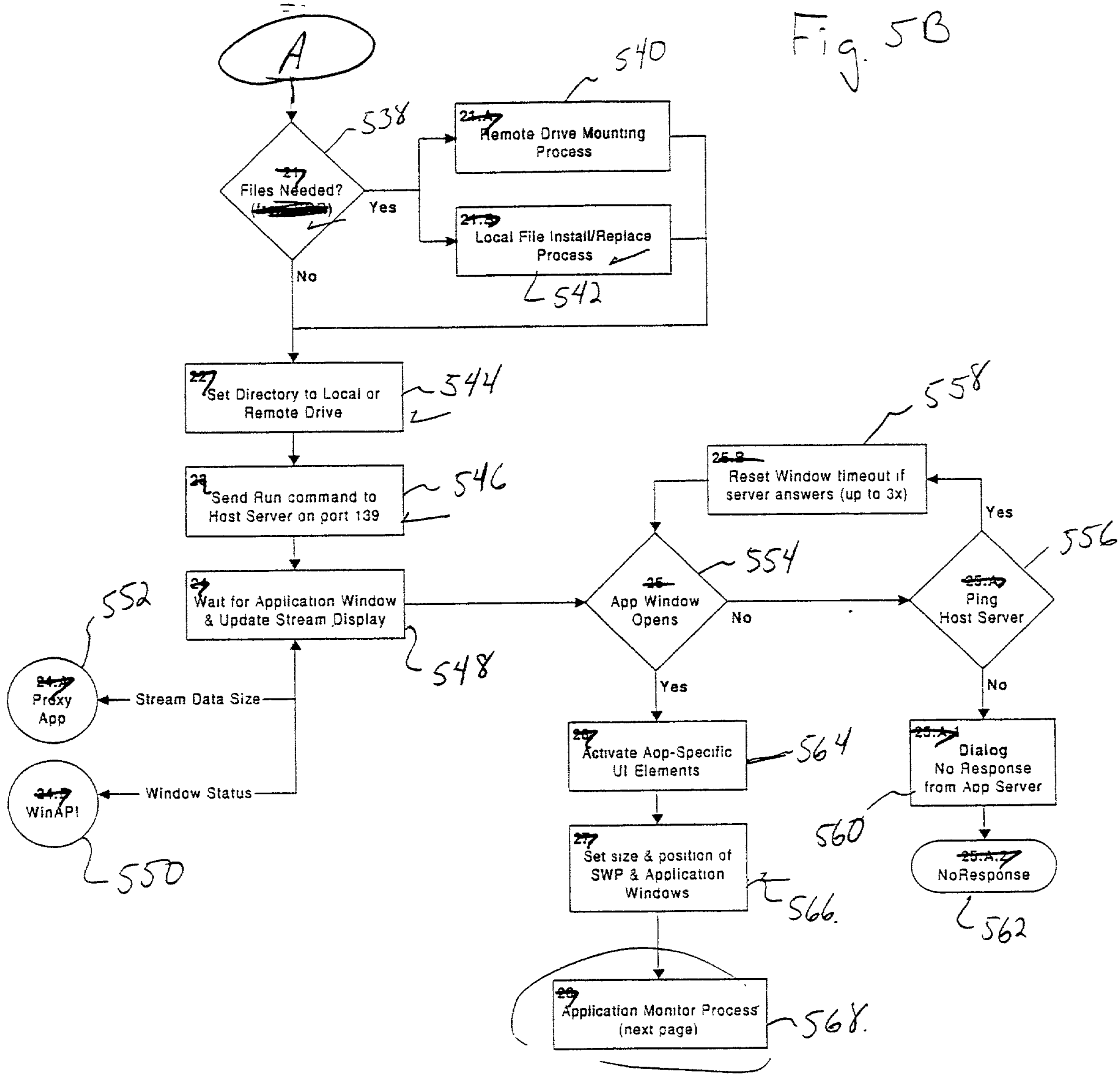


Fig. 5 A

Application Launch Process (2/2)

Fig. 5B



Application Monitoring_Processes (1/3)

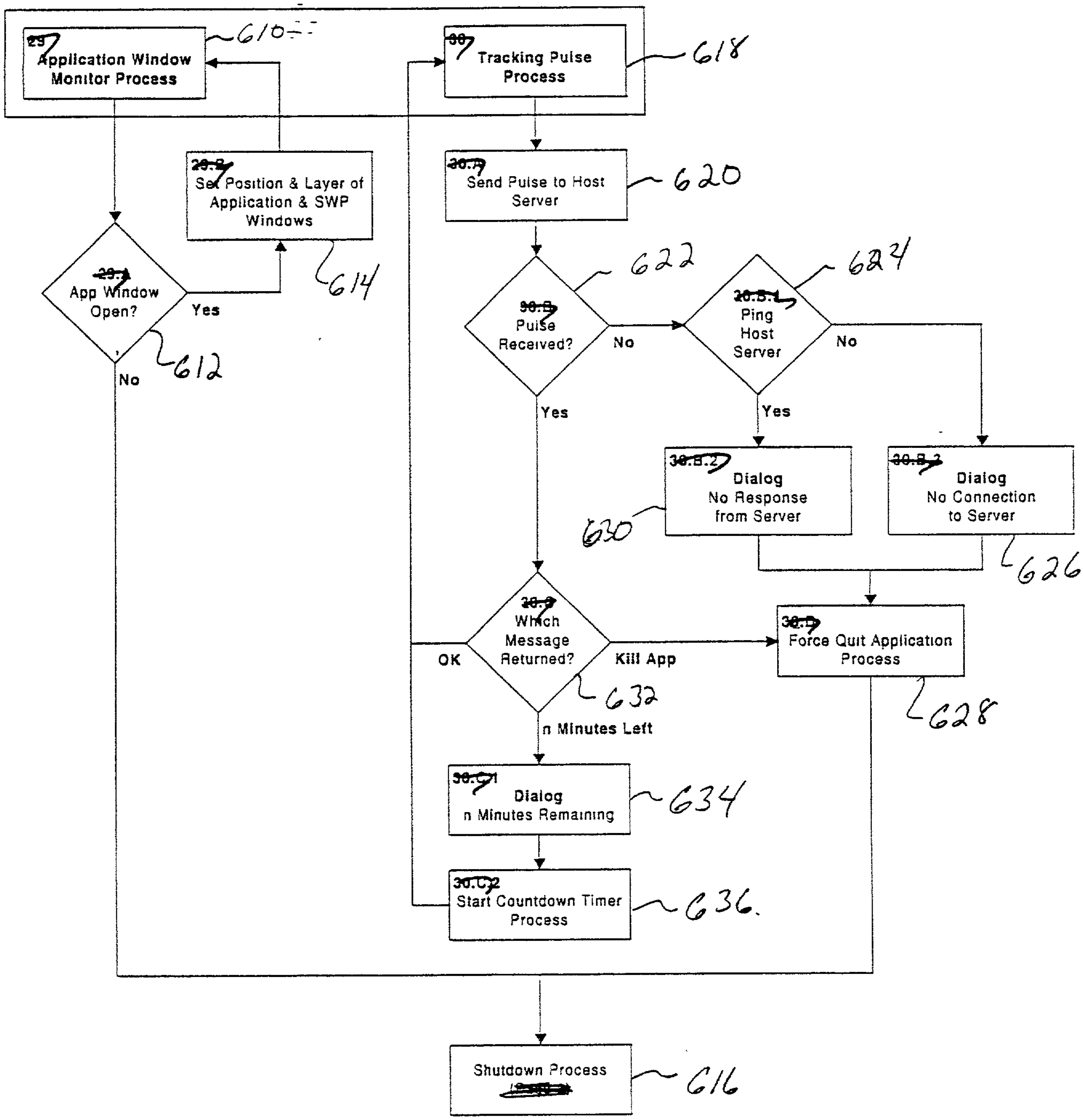


Fig. 6A

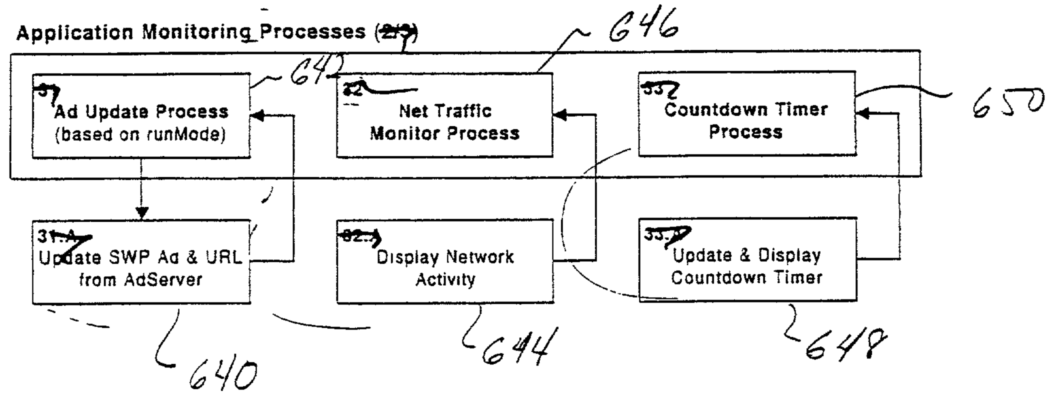

Application Monitoring Processes
Ad Update Process
(based on runMode)
Net Traffic
Monitor Process
Countdown Timer
Process
Update SWP Ad & URL
from AdServer
Display Network
Activity
Update & Display
Countdown Timer
646
642
650
640
644
648

Fig 6B

Application Monitoring Processes ~~(3/3)~~ 7

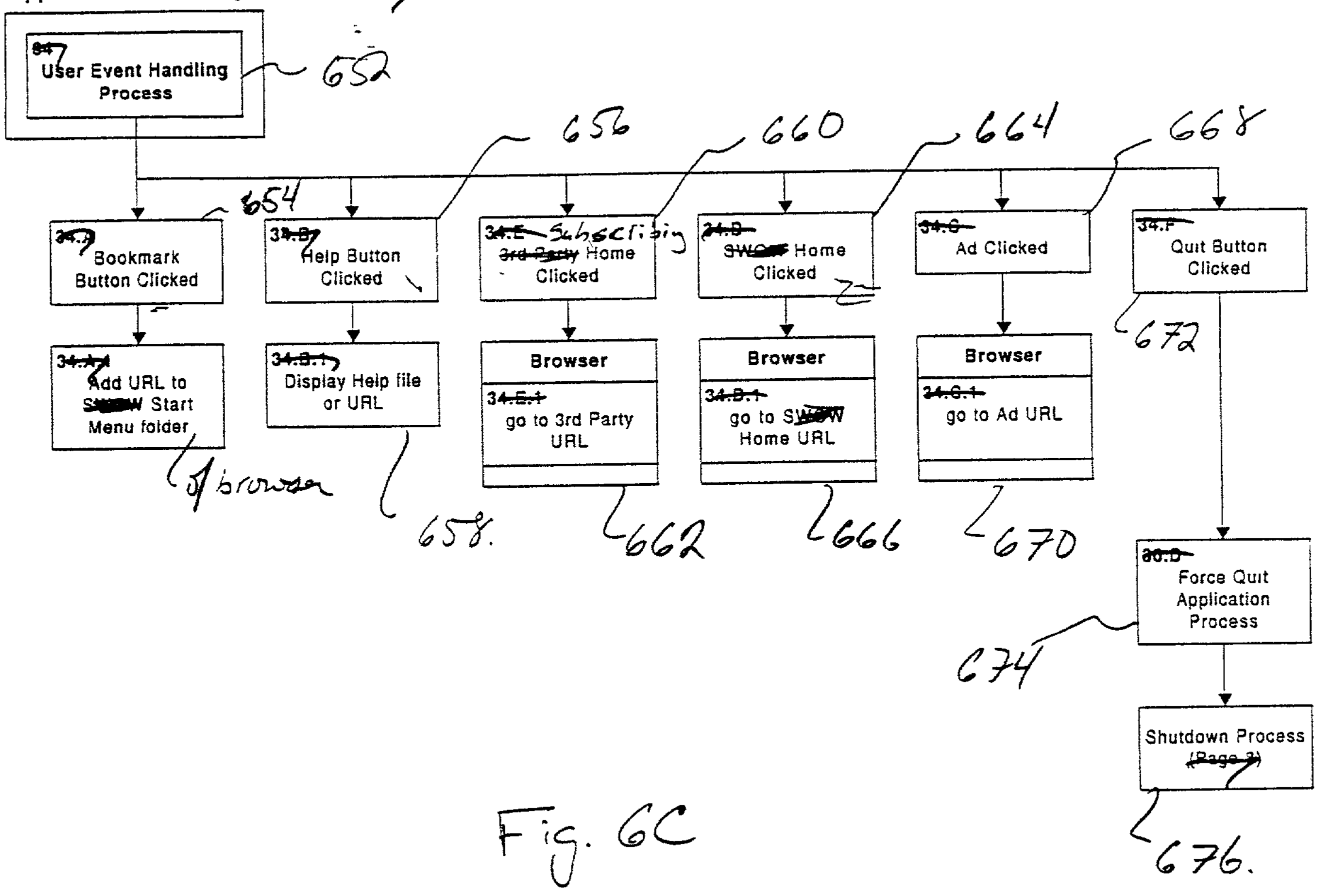


Fig. 6C

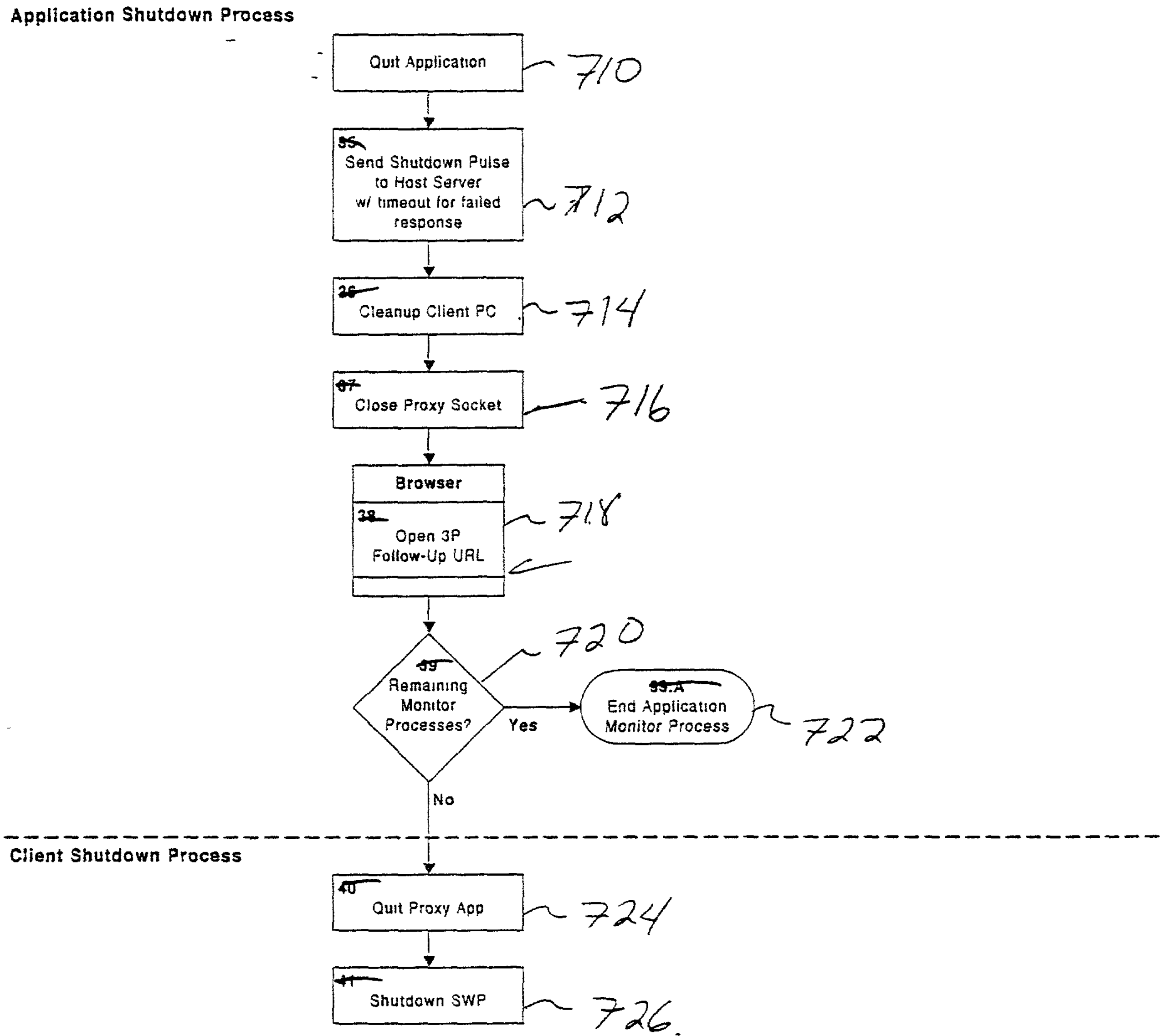
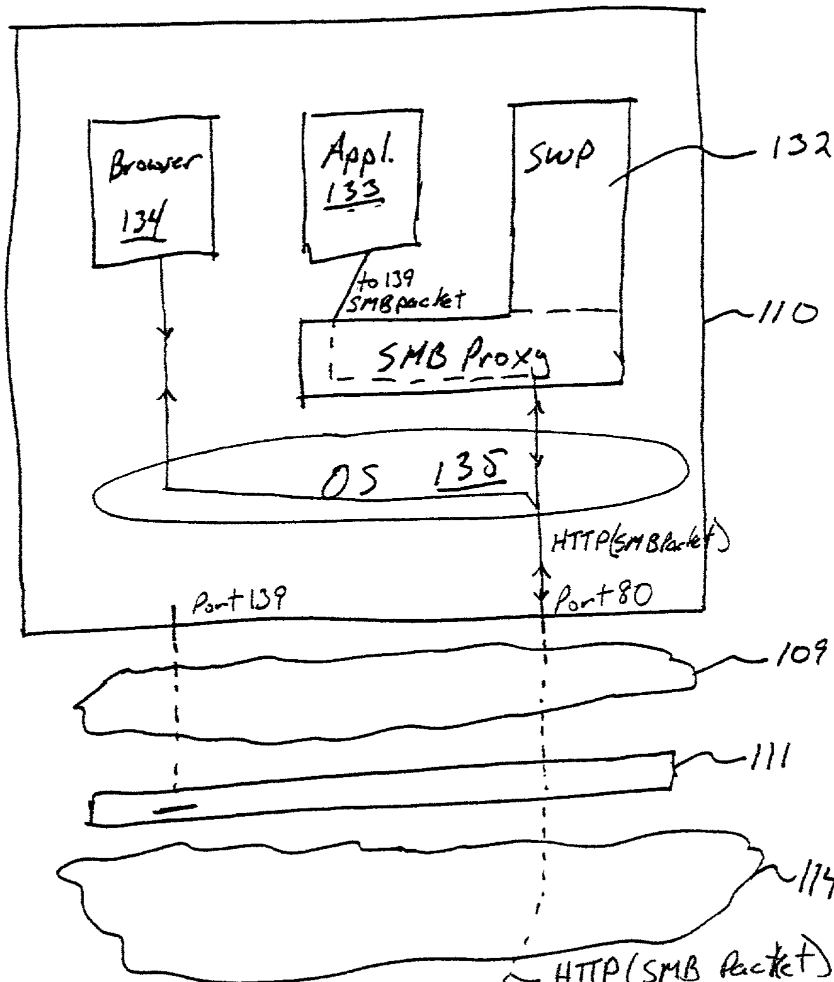

Application Shutdown Process
Quit Application
710
Send Shutdown Pulse to Host Server w/ timeout for failed response
712
Cleanup Client PC
714
Close Proxy Socket
716
Browser
Open 3P Follow-Up URL
718
Remaining Monitor Processes?
720
Yes
End Application Monitor Process
722
No
Client Shutdown Process
Quit Proxy App
724
Shutdown SWP
726.

Fig. 7


Browser
134
Appl.
133
SWP
132
to 139
SMB packet
SMB Proxy
110
OS 135
HTTP(SMB Packet)
Port 139
Port 80
109
111
114
HTTP(SMB Packet)

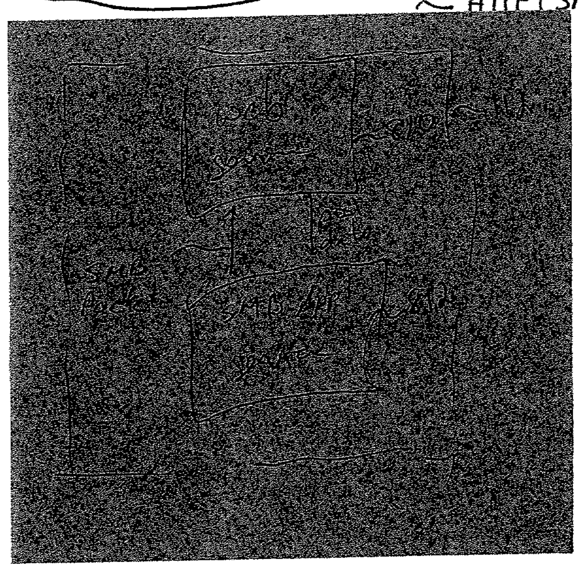


Fig. 8

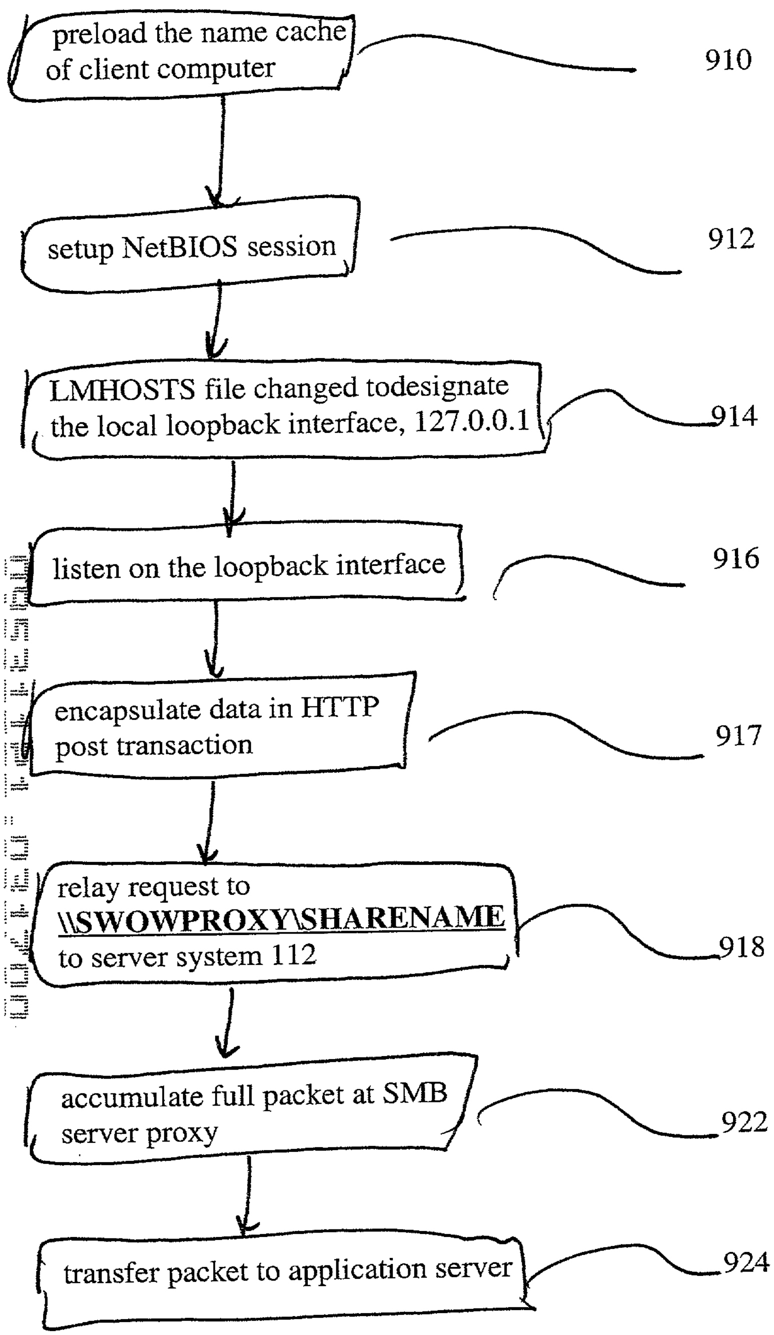

preload the name cache of client computer
910
setup NetBIOS session
912
LMHOSTS file changed todesignate the local loopback interface, 127.0.0.1
914
listen on the loopback interface
916
encapsulate data in HTTP post transaction
917
relay request to \\SWOWPROXY\SHARENAME to server system 112
918
accumulate full packet at SMB server proxy
922
transfer packet to application server
924

Fig. 9